

# Evaluation of Vaginal Complaints

Matthew R. Anderson, MD, MS

Kathleen Klink, MD

Andreas Cohrsen, MD

## CLINICAL SCENARIOS

### Case 1

An otherwise healthy 33-year-old woman presents with a complaint of foul-smelling vaginal discharge. She is sexually active with 1 male partner. This is the first time she has had this symptom and is worried that it may represent a serious health problem. What diagnostic maneuvers—history, physical examination, and office laboratory tests—will allow the clinician to determine the cause of her symptoms?

### Case 2

A 35-year-old woman with 2 sexual partners in the last year complains of an itchy, smelly discharge. The pelvic examination reveals no vulvar or vaginal inflammation; a foamy, thin discharge with a pH of 5.0; and some bleeding at the cervix. The wet prep reveals 2 clue cells per high-power field and—after thorough review of the slide—no motile organisms are seen. What is the chance that this patient has vaginal candidiasis, bacterial vaginosis, or vaginal trichomoniasis?

## Why Is the Clinical Examination Important?

Vaginal complaints are extremely common in primary care. They are the most common reason for gynecological consultation and account for approxi-

See also Patient Page.

CME credit available online  
at [www.jama.com](http://www.jama.com)

**Context** Vaginal symptoms are one of the most common reasons for gynecological consultation. Clinicians have traditionally diagnosed vaginal candidiasis, bacterial vaginosis, and vaginal trichomoniasis using some combination of physical examination, pH, the wet mount, and the whiff test.

**Objectives** To evaluate the role of the clinical examination and determine the positive and negative likelihood ratios (LRs) for the diagnosis of vaginal candidiasis, bacterial vaginosis, and vaginal trichomoniasis.

**Data Sources** Using a structured literature review, we abstracted information on sensitivity and specificity for symptoms, signs, and office laboratory procedures. We chose published (1966 to April 2003) articles that appeared in the MEDLINE database and were indexed under the combined search terms of *diagnosis with vaginitis, vaginal discharge, candidiasis, bacterial vaginosis, and trichomoniasis*.

**Study Selection** Included studies of symptomatic premenopausal women seen in primary care settings. Tests were evaluated only if they would provide diagnostic information during the office visit and were compared with an acceptable criterion standard.

**Data Extraction** All 3 authors extracted the data and computed sensitivity and specificity from each article independently. The absence of standard definitions for symptoms and signs made it impossible to combine results across studies.

**Data Synthesis** Symptoms alone do not allow clinicians to distinguish confidently between the causes of vaginitis. However, a patient's lack of itching makes candidiasis less likely (range of LRs, 0.18 [95% confidence interval {CI}, 0.05-0.70] to 0.79 [95% CI, 0.72-0.87]) and lack of perceived odor makes bacterial vaginosis unlikely (LR, 0.07 [95% CI, 0.01-0.51]). Similarly, physical examination signs are limited in their diagnostic power. The presence of inflammatory signs is associated with candidiasis (range of LRs, 2.1 [95% CI, 1.5-2.8] to 8.4 [95% CI, 2.3-31]). Presence of a "high cheese" odor on examination is predictive of bacterial vaginosis (LR, 3.2 [95% CI, 2.1-4.7]) while lack of odor is associated with candidiasis (LR, 2.9 [95% CI, 2.4-5.0]). Office laboratory tests, particularly microscopy of vaginal discharge, are the most useful way of diagnosing these 3 conditions.

**Conclusions** The cause of vaginal complaints may be easily diagnosed when typical findings appear in microscopy. However, the poor performance of individual symptoms, signs, and office laboratory tests often makes it problematic to identify the cause of vaginal symptoms.

JAMA. 2004;291:1368-1379

[www.jama.com](http://www.jama.com)

mately 10 million office visits annually.<sup>1</sup> Current recommendations for the diagnosis of vaginal complaints in pre-

menopausal women involve a vaginal examination and microscopy. The evaluation has traditionally been ori-

**Author Affiliations:** Department of Family and Social Medicine, Albert Einstein College of Medicine, Bronx, NY (Dr Anderson), Center for Family Medicine in the College of Physicians and Surgeons, Columbia University, New York, NY (Dr Klink), Department of Family Practice, Beth Israel Medical Center/The Institute for Urban Family Health, New York, NY (Dr Cohrsen).

**Corresponding Author:** Matthew R. Anderson, MD, MS, Montefiore Family Health Center, 360 E 193rd St, Bronx, NY 10458 ([andersonma@aol.com](mailto:andersonma@aol.com)).

**The Rational Clinical Examination Section Editors:** David L. Simel, MD, MHS, Durham Veterans Affairs Medical Center and Duke University Medical Center, Durham, NC; Drummond Rennie, MD, Deputy Editor, JAMA.

ented toward the detection of vaginal candidiasis, bacterial vaginosis, and trichomoniasis, which are the 3 most common causes of vaginitis in this age group.<sup>2-4</sup>

Prevalence of these 3 conditions will vary depending on the clinical setting. National figures show that 40% to 50% of patients with vaginal symptoms have bacterial vaginosis; 20% to 25% have vaginal candidiasis; and 15% to 20% have trichomoniasis.<sup>5</sup> In the studies surveyed for this review, which involved symptomatic women presenting in primary care, the prevalence of vaginal candidiasis ranged from 17% to 39%<sup>6,7</sup>; bacterial vaginosis, 22% to 50%<sup>8,9</sup>; and trichomoniasis, 4% to 35%.<sup>10,11</sup> The number of undiagnosed patients ranged from 7% to 72%.<sup>6,12</sup>

Women who present with vaginal complaints often receive tests for gonorrhea or chlamydia. However, the association between gonorrhea, chlamydia, and vaginal discharge is not confirmed.<sup>13,14</sup> It would be prudent, however, to test for gonorrhea and chlamydia in sexually active patients who are younger than 25 years and in all patients who have fever, lower abdominal pain, a symptomatic sexual partner, a new sexual partner, or more than 1 sexual partner.<sup>14</sup> Additional less common causes of vulvovaginal symptoms are infection with herpes simplex<sup>15</sup>; allergic reactions to chemical irritants, latex,<sup>16</sup> or semen<sup>17</sup>; mechanical irritation due to lack of lubrication; and atrophic vaginitis in postmenopausal women.<sup>18</sup>

About 30% of women with vaginal complaints go without a diagnosis even after a complete evaluation using techniques more comprehensive than those usually available.<sup>8,19,20</sup> Perhaps this explains why many clinicians appear to manage patients without performing a pH examination of the discharge or microscopy.<sup>21</sup> In actual clinical practice, diagnoses of vaginal complaints do not show good agreement with diagnoses based on cultures.<sup>22</sup> These concerns led us to evaluate the role of the clinical examination in the diagnosis of vaginal complaints.

Point-of-care testing for vaginal complaints is a new and rapidly evolving

field. A number of commercially available office kits use a vaginal discharge sample to diagnose bacterial vaginosis,<sup>23</sup> trichomoniasis,<sup>23</sup> and vaginal candidiasis.<sup>6</sup> A systematic review of these diagnostic kits is, however, beyond the scope of this article.

### How to Elicit Symptoms and Signs

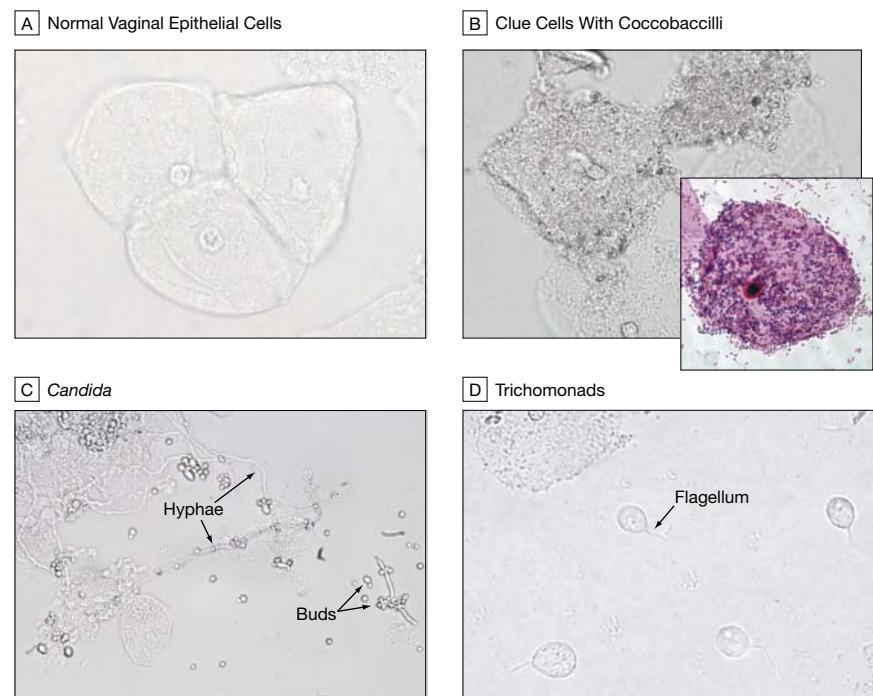
**Elicitation of Symptoms.** Patients who have vaginitis generally complain of some combination of discharge, odor, irritation, or itch. Discharges are characterized by color (clear, white, green, gray, yellow), consistency (thin, thick, curdlike), and amount (more or less than usual). We could locate no scale that allows the patient to quantify precisely the amount of her discharge.

**Signs.** Patients may have irritation manifested as erythema, excoriation, or discharge on the perineum or introitus. The discharge is sampled during a speculum examination with a swab from the posterior fornix or picked up on the speculum. Some clinicians ask patients to provide a self-collected sample of their vaginal discharge.<sup>24</sup>

The sample can be tested for pH using phenolphthazine paper. When gel is used on the speculum, care must be taken not to contaminate the sample as the pH may become altered. In addition, semen, douches, and intravaginal medication can all make the vaginal pH more basic.

Characteristic findings on the wet mount are shown in the FIGURE. Microscopy is performed by placing a drop

**Figure.** Microscopic Examination of Vaginal Samples



A, Normal saline wet mount showing a clump of 3 normal vaginal epithelial cells (original magnification  $\times 600$ ). Reproduced with permission from William L. Thelmo, MD. B, Normal saline wet mount showing 2 clue cells (original magnification  $\times 400$ ). Inset, Gram stain demonstrating how coccobaccilli on the surface of vaginal epithelial cells create the characteristic granular appearance and indistinct borders of clue cells (original magnification  $\times 1000$ ). Reproduced with permission from Lorna Rabe, Magee-Womens Research Institute, Pittsburgh, PA. C, Normal saline wet mount showing numerous *Candida* hyphae and buds (original magnification  $\times 400$ ). Reproduced with permission from Lorna Rabe. D, Normal saline wet mount showing 4 trichomonads. Trichomonads can often be identified easily because of their characteristic jerky motility (original magnification  $\times 600$ ). Reproduced with permission from the Medical Laboratory Evaluation proficiency testing program of the American College of Physicians Services Inc.

of vaginal fluid on 2 slides. A drop of saline is mixed with the discharge on 1 slide, while a drop of 10% potassium hydroxide is placed on the second slide. The examiner then “whiffs” the potassium hydroxide slide to determine the presence of the characteristic fishy (amine) odor of bacterial vaginosis. The potassium hydroxide slide is set aside or put on a warmer. The other vaginal sample is examined under 400× power for trichomonads, clue cells, yeasts, presence or absence of lactobacilli (long rods<sup>25</sup>), and the presence of leukocytes. Clue cells are epithelial cells with a finely granulated cytoplasm and indistinct borders,<sup>26</sup> which appear to have been coated with sand. The potassium hydroxide slide is examined for yeast. Yeast may be seen on the saline preparation, obviating the need to perform the potassium hydroxide microscopic examination.

Two excellent resources exist for learning how to perform the wet mount examination and whiff test. The Seattle STD/HIV Prevention Training Center has produced a short, downloadable instructional video.<sup>27</sup> The video illustrates the technique of the wet mount examination and includes clips of common findings such as yeast, clue cells, and motile trichomonads. For those more comfortable with paper materials, the Association of Professors of Gynecology and Obstetrics’ pamphlet on the diagnosis of vaginitis<sup>28</sup> contains photographs of the methods and findings of the wet mount examination.<sup>29</sup>

Under the Clinical Laboratory Improvement Act, the wet mount examination is considered a moderately complex test and the practitioner’s laboratory must obtain a Certificate of Provider-Performed Microscopy Procedures from the local state health department.<sup>30</sup>

## METHODS

### Search Strategy

We undertook a MEDLINE review of the literature from 1966 through April 2003 combining the term *diagnosis* with the terms *vaginitis*, *vaginal discharge*, *candidiasis*, *bacterial vaginosis*, and

*trichomoniasis*. We reviewed more than 500 abstracts and obtained a copy of articles (>100) that appeared likely to meet our review criteria. We also examined all articles mentioned in the most recent American College of Obstetricians and Gynecologists *Technical Bulletin*.<sup>3</sup> Each article was reviewed by at least 1 author and in ambiguous cases by all 3. Included articles and review articles were culled for further references. We attempted to contact the authors of all articles included in this review and to request additional references. We received replies from 7 authors, but no additional references were produced.

### Inclusion and Exclusion Criteria

Articles were included if they (1) involved original research performed on symptomatic patients in a primary care setting (including sexually transmitted disease clinics), (2) compared a diagnostic test with a recognized criterion standard, (3) allowed the calculation of sensitivity and/or specificity, and (4) discussed tests that would provide diagnostic information during the course of the office visit. We excluded articles that reported on women seen in specialty or referral settings, those with recurrent or treatment-refractory vaginitis, or asymptomatic patients (for example, women seen for routine pelvic examination).

### Evaluation of Methods

Eighteen articles met our inclusion and exclusion criteria and are listed in TABLE 1.<sup>6-12,23,31-40</sup> We graded the articles’ methodological quality on a 3-point scale (highest to lowest quality). The grading and criteria are listed in the BOX.

### Evaluation of Criterion Standards

The diagnostic criterion standard for vaginal candidiasis is a positive culture and/or identification of yeast by microscopy. Because many asymptomatic women have vaginal yeast colonization, it is not clear if a positive culture or microscopy alone confirms *Candida* as the cause of symp-

toms, yet this is the current diagnostic criterion standard. We accepted studies that used microscopy only as a criterion standard but considered these of lower quality.

We used the Amsel criteria<sup>41</sup> as the criterion standard for the diagnosis of bacterial vaginosis. Bacterial vaginosis is diagnosed when 3 of 4 findings are present: (1) a thin, homogeneous vaginal discharge, (2) clue cells, (3) positive whiff test, and (4) vaginal pH level higher than 4.5.<sup>41</sup> Several articles used either Gram stain or a positive culture for *Gardnerella vaginalis* as criterion standards, which we also accepted, although we did not consider this optimal.

The criterion standard applied to the diagnosis of trichomoniasis is a positive culture. Immunofluorescence and polymerase chain reaction are probably equivalent to culture. We accepted studies that included identification of trichomonads by direct microscopy or Papanicolaou tests, although these were considered of lesser quality.

### Data Extraction

Sensitivity, specificity, and likelihood ratios (LRs) were either taken directly from the article or calculated from data provided in the article. All of the authors extracted the data and computed sensitivity and specificity from each article independently. Disagreements were resolved by consensus. All data and any calculations were sent to the primary authors for their review. One author (Abbott<sup>12</sup>) provided additional data that have been incorporated into this review. A fourth person independently verified all data points. The absence of standard definitions for a variety of symptoms and signs, along with ambiguous phrasing of terms, made it impossible to combine results across studies.

### Statistical Analysis

Statistical analysis was performed using SPSS (version 10.0, SPSS Inc, Chicago, Ill) and STATA (version 8, STATA Corp, College Station, Tex) statistical software. When there were no

**Table 1.** Included Studies of Diagnostic Strategies for Vaginal Symptoms

| Source                                    | No. of Patients | Setting   | Symptoms  | Vaginal Candidiasis, No. (%) | Bacterial Vaginosis, No. (%) | Vaginal Trichomoniasis, No. (%) | Quality Score* | Criterion Standard   |
|---|-----------------|---|---|------------------------------|------------------------------|---------------------------------|----------------|--|
| Abbott, <sup>12</sup> 1995†               | 71              | Urban ED or walk-in clinic; Denver, Colo  | Vaginal itching, discharge, or pain               | 23 (32)                      | 29 (41)                      | 5 (7)                           | 2              | Candidiasis: culture only  |
| Abu Shaqra, <sup>31</sup> 2001            | 301             | Private gynecologists; Zarka, Jordan  | Vaginal discharge                                 | 78 (26)                      | 90 (30)                      | 9 (3)                           | 2              | Bacterial vaginosis: Nugent criteria‡  |
| Bennett et al, <sup>11</sup> 1989         | 157             | Urban ED; Kansas City, Mo   | Vaginal discharge                                 | NA                           | NA                           | 55 (35)                         | 2              | Trichomoniasis: culture, microscopy, immunofluorescence                                      |
| Bleker et al, <sup>32</sup> 1989§         | 97              | Urban general hospital gynecology clinic; Amsterdam, the Netherlands                                  | Vaginal discharge                                 | 24 (25)                      | 37 (38)                      | 13 (13)                         | 3              | Bacterial vaginosis: Spiegel criteria  ; trichomoniasis: microscopy; candidiasis: microscopy |
| Borchardt et al, <sup>33</sup> 1992       | 69              | 3 clinics (1 STD clinic); San Jose, Costa Rica  | Not indicated                                     | NA                           | NA                           | 10 (15)                         | 2              | Trichomoniasis: culture  |
| Briselden and Hillier, <sup>23</sup> 1994 | 176             | STD clinic; Seattle, Wash   | Genital complaints                                | NA                           | 79 (45)                      | 19 (11)                         | 2              | Bacterial vaginosis: clinical criteria; trichomoniasis: culture, microscopy                  |
| Bro, <sup>7</sup> 1989                    | 361             | General practices (n = 29); Aarhus, Denmark   | Increased vaginal discharge, malodor, or pruritus | 141 (39)                     | NA                           | NA                              | 2              | Candidiasis: culture, microscopy   |
| Carlson et al, <sup>6</sup> 2000¶         | 124             | Gynecology outpatient clinic; Helsinki, Finland   | Suspected vaginitis                               | 21 (17)                      | NA                           | NA                              | 2              | Candidiasis: culture   |
| Chandeying et al, <sup>10</sup> 1998      | 240             | University gynecology outpatient clinic; Songkila, Thailand   | Vaginal discharge                                 | 53 (22)                      | 91 (38)                      | 10 (4)                          | 3              | Bacterial vaginosis: Amsel criteria#; candidiasis: microscopy; trichomoniasis: microscopy    |
| Eckert et al, <sup>34</sup> 1998          | 774             | STD clinic; Washington state  | "A new problem"                                   | 186 (24)                     | 294 (38)                     | 116 (15)                        | 2              | Candidiasis: culture   |
| Fule et al, <sup>35</sup> 1990            | 200             | Hospital gynecology clinic; Solapur, India  | Abnormal vaginal discharge                        | NA                           | 34 (17)                      | NA                              | 2              | Bacterial vaginosis: culture and exclusion of other causes                                   |
| Holst et al, <sup>36</sup> 1987           | 101             | Community health center; Lund, Sweden   | Genital malodor or abnormal vaginal discharge     | 23 (23)                      | 34 (34)                      | 9 (9)                           | 2              | Bacterial vaginosis: Amsel criteria#   |
| Krieger et al, <sup>37</sup> 1988         | 600             | STD clinic; Seattle, Wash   | "New problems"                                    | NA                           | NA                           | 90 (15)                         | 2              | Trichomoniasis: culture  |
| Livengood et al, <sup>38</sup> 1990       | 67              | 2 Hospital gynecology clinics   | NA  | NA                           | 67 (100)                     | NA                              | 2              | Bacterial vaginosis: Amsel criteria#   |
| O'Dowd and West, <sup>9</sup> 1987**      | 162             | Department of General Practice; Nottingham, England   | Vaginal symptoms                                  | NA                           | 81 (50)                      | NA                              | 3              | Bacterial vaginosis: culture only  |
| Ryu et al, <sup>39</sup> 1999             | 177             | University obstetrics/ gynecology clinic; Seoul, Korea  | Vaginal discharge                                 | NA                           | NA                           | 18 (10)                         | 2              | Trichomoniasis: culture  |
| Schaaf et al, <sup>8</sup> 1990††         | 123             | County hospital family planning clinic or community-based women's health center; San Francisco, Calif | Evaluation for vaginitis                          | 32 (26)                      | 27 (22)                      | 9 (7)                           | 2              | Bacterial vaginosis: Amsel criteria#; trichomoniasis: culture; candidiasis: culture          |
| Wathne et al, <sup>40</sup> 1994‡‡        | 101             | Swedish community health center; Lund, Sweden   | Vaginal discharge or malodor                      | 23 (23)                      | 34 (34)                      | 9 (9)                           | 2              | Bacterial vaginosis: Amsel criteria#; trichomoniasis: culture; candidiasis: culture          |

Abbreviations: ED, emergency department; NA, information not reported; STD, sexually transmitted disease.

\*See Box for criteria for quality scoring.

†Additional unpublished data from Abbott were included in this review.

‡Determined using criteria from Nugent et al.<sup>25</sup>

§Twenty-two patients were not diagnosed.

¶Determined using criteria from Spiegel et al.<sup>51</sup>

¶Seventy-four patients were not diagnosed.

#Determined using criteria from Amsel et al.<sup>41</sup>

\*\*Nineteen patients were not diagnosed.

††Fifty-one patients were not diagnosed. Women with herpes or urinary tract infections were excluded.

‡‡Data appear to be same as in Holst et al.<sup>36</sup> Data on bacterial vaginosis were reported differently in this article and have been excluded from our analysis.



**Box. Criteria for Quality Scoring****Level 1**

Explicit inclusion and exclusion criteria

More than 95% of patients received specified diagnostic workup including criterion standard

More than 2 persons performed the diagnostic test and a measure was made of interobserver variability

Sensible normal range defined for continuous variables (when applicable) and criterion standards were used (Amsel<sup>41</sup> criteria for bacterial vaginosis; culture for vaginal trichomoniasis; and culture for vaginal candidiasis)

(No studies met all level 1 criteria)

**Level 2**

Level 2 studies failed 1 or more level 1 criteria and/or used the following criterion standards: for bacterial vaginosis, Amsel<sup>41</sup> modification, Spiegel,<sup>51</sup> Nugent,<sup>25</sup> culture and exclusion of other causes; for vaginal trichomoniasis, polymerase chain reaction, immunofluorescence; and for vaginal candidiasis, culture

(Fifteen studies met level 2 criteria)

**Level 3**

Level 3 studies failed 1 or more level 1 criteria and/or used the following criterion standards: for bacterial vaginosis, *Gardnerella* culture; for vaginal trichomoniasis, microscopy, or Papanicolaou test; and for vaginal candidiasis, microscopy

(Three studies met level 3 criteria)

patients in 1 of the 4 cells of a 2 × 2 table (true-positive, false-positive, false-negative, true-negative), the value 0.5 was added to each cell of the 2 × 2 table for calculating the LRs.

It may be helpful to consider the specifics of the clinical setting and how they influence the interpretation of LRs. Pretest probabilities for the 3 major diagnoses in symptomatic women (ie, reported prevalences for these conditions in primary care) are in the 15% to 40% range. A positive LR of 3 will increase a pretest probability from 15% to 35% and one of 40% will increase to 67%; a positive LR of 6 will increase a pretest probability from 15% to 51% and one of 40% will increase to 80%. A negative LR of 0.10 will decrease a pretest probability of 15% to 2% and a pretest probability of 40% to 6.3%.

**RESULTS****Precision**

Precision refers to the degree to which independent observers will find the same result when applying the same test. No study reported the precision of the tests reviewed in this article.

**Accuracy of Symptoms**

TABLE 2 and TABLE 3 present the sensitivity, specificity, and LRs for all symptoms. The reviewed articles tested the following symptoms for their usefulness in the diagnosis of vaginal complaints: (1) characteristics of the discharge (quantity, color, consistency), (2) presence or absence of itching, (3) irritative symptoms (redness, pain/burning, swelling), (4) odor (present, fishy, or foul), (5) patient's self-diagnosis, (6) urinary tract symptoms, (7) bleeding, and (8) dyspareunia.

**Discharge Characteristics.** Patients' descriptions of their discharge do not appear useful diagnostically with 1 exception. A "cheesy" discharge increases the likelihood of candidiasis (LR, 2.4; 95% confidence interval [CI], 1.4-4.2), while a watery discharge makes it less likely (LR, 0.12; 95% CI, 0.02-0.82).

**Itching.** Several studies confirm that 70% to 90% of patients with vaginal candidiasis complain of itching (range of LRs, 1.4 [95% CI, 1.2-1.7] to 3.3 [95% CI, 2.4-4.8]). Similarly, these studies show LRs ranging from 0.18

(95% CI, 0.05-0.70) to 0.79 (95% CI, 0.72-0.87) for women who do not have itching; thus, lack of itching decreases the likelihood of candidal infection. Itching symptoms are not useful for assessing the likelihood of bacterial vaginosis or trichomoniasis.

**Irritative Symptoms.** The limited data suggest that irritative symptoms are slightly useful in the diagnosis of candidiasis. Erythema increases the likelihood of candidiasis slightly (LR, 2.0; 95% CI, 1.5-2.8); its absence decreases its likelihood (LR, 0.84; 95% CI, 0.76-0.92).

**Odor.** The presence of an odor perceived by the patient decreases the likelihood of candidiasis (range of LRs, 0.35 [95% CI, 0.16-0.77] to 0.48 [95% CI, 0.23-1.0]), while the absence of an odor increases its likelihood (range of LRs, 1.6 [95% CI, 1.1-2.4] to 2.1 [95% CI, 1.5-3.0]). Complaints of malodor (or odor) are so strongly associated with bacterial vaginosis that absence of malodor virtually ruled out the condition in 1 study (LR, 0.07; 95% CI, 0.01-0.51).<sup>36</sup> A fishy odor noticed by the patient is not helpful in diagnosing trichomoniasis.

**Self-diagnosis.** Women who complain of having "another yeast infection" are more likely to have candidiasis (LR, 3.3; 95% CI, 1.2-9.1).

Urinary tract symptoms were not found to be associated with any of the 3 diagnoses in 1 study,<sup>8</sup> while Eckert et al<sup>34</sup> found "external" dysuria associated with candidiasis.

**Bleeding.** In one study of 17 patients with trichomoniasis, no patient complained of postcoital bleeding.<sup>39</sup> Of 67 patients with bacterial vaginosis in the study by Livengood et al,<sup>38</sup> only 4% complained of abnormal bleeding.

**Dyspareunia.** Only 1 of 17 patients with trichomoniasis complained of dyspareunia, which is a nonsignificant association.<sup>39</sup>

**Accuracy of Signs**

TABLE 4 and TABLE 5 present the sensitivity, specificity, and LRs for all signs. We evaluated (1) characteristics of the discharge (amount, color, consistency), (2) inflammatory findings (edema,

erythema, excoriations, tenderness, mucopus), and (3) odor.

**Discharge.** The finding of a discharge on examination does not distinguish between the 3 conditions. More than 60% of patients with these

diagnoses have a discharge. A thick, curdy, or flocculent white discharge is strongly predictive of candidiasis (range of LRs, 2.7 [95% CI, 1.3-5.5] to 130 [95% CI, 19-960]). The absence of these characteristics makes candidiasis less

likely (range of LRs, 0.28 [95% CI, 0.19-0.44] to 0.86 [95% CI, 0.80-0.93]). Women whose discharge is judged normal (LR, 0.11; 95% CI, 0.01-0.86) to mild (LR, 0.53; 95% CI, 0.37-0.75) are less likely to have bacterial vaginosis

**Table 2.** Accuracy of Symptoms for Diagnosis of Vaginal Candidiasis or Bacterial Vaginosis

| Symptom                                       | Diagnosis | No. of Patients With Diagnosis | Sensitivity, % | Specificity, % | LR (95% CI)      |                  | Reference |
|---|-----------|--------------------------------|----------------|----------------|------------------|------------------|-----------|
|   |           |                                |                |                | Positive         | Negative         |           |
| Type of discharge described by patient<br>Any | VC        | 32*                            | 72 (NS)        |                |                  |                  | 8         |
|   | BV        | 27*                            | 59 (NS)        |                |                  |                  | 8         |
|   | BV        | 67                             | 91             |                |                  |                  | 38        |
| Cheesy  | VC        | 23                             | 65             | 73             | 2.4 (1.4-4.2)    | 0.48 (0.27-0.86) | 12        |
| Increased                                     | VC        | 186                            | NS             |                |                  |                  | 34        |
|   | BV        | 34                             | 59             | 67             | 1.8 (1.2-2.8)    | 0.61 (0.40-0.95) | 36        |
| Watery  | VC        | 23                             | 4              | 63             | 0.12 (0.02-0.82) | 1.5 (1.2-1.9)    | 12        |
| White   | VC        | 32*                            | 41 (NS)        |                |                  |                  | 8         |
|   | VC        | 186                            | NS             |                |                  |                  | 34        |
| Yellow  | VC        | 32*                            | 19 (NS)        |                |                  |                  | 8         |
|   | VC        | 186                            | NS             |                |                  |                  | 34        |
|   | BV        | 27*                            | 26 (NS)        |                |                  |                  | 8         |
| Malodor or odor                               | VC        | 23                             | 26             | 46             | 0.48 (0.23-1.0)  | 1.6 (1.1-2.4)    | 12        |
|   | VC        | 32*                            | 16 (NS)        |                |                  |                  | 8         |
|   | VC        | 23                             | 21             | 37             | 0.35 (0.16-0.77) | 2.1 (1.5-3.0)    | 40        |
|   | BV        | 34                             | 97             | 40             | 1.6 (1.3-2.0)    | 0.07 (0.01-0.51) | 36        |
|   | BV        | 67                             | 73             |                |                  |                  | 38        |
|   | BV        | 27*                            | 41 (NS)        |                |                  |                  | 8         |
|   | BV        | 34                             | 53             |                |                  |                  | 40        |
| Itching                                       | VC        | 23                             | 87             | 50             | 1.7 (1.3-2.4)    | 0.26 (0.09-0.78) | 12        |
|   | VC        | 140                            | 79             | 58             | 1.8 (1.6-2.2)    | 0.38 (0.27-0.53) | 7         |
|   | VC        | 32*                            | 69 (NS)        |                |                  |                  | 8         |
|   | VC        | 23                             | 91             | 47             | 1.7 (1.4-2.2)    | 0.18 (0.05-0.70) | 40        |
|   | VC†       | 186                            | 50             | 64             | 1.4 (1.2-1.7)    | 0.78 (0.67-0.91) | 34        |
|   | BV        | 34                             | 41             | 37             | 0.66 (0.42-1.0)  | 1.6 (1.0-2.4)    | 36        |
|   | BV        | 27*                            | 67 (NS)        |                |                  |                  | 8         |
| Chief complaint                               | VC        | 186                            | 27             | 92             | 3.3 (2.4-4.8)    | 0.79 (0.72-0.87) | 34        |
| Irritation                                    | BV        | 67                             | 45             |                |                  |                  | 38        |
|   | BV        | 27*                            | 48 (NS)        |                |                  |                  | 8         |
| Pain or burning†                              | VC        | 32*                            | 69 (NS)        |                |                  |                  | 8         |
| Redness†                                      | VC        | 186                            | 20             | 88             |                  |                  | 34        |
|   | VC        | 186                            | 28             | 86             | 2.0 (1.5-2.8)    | 0.84 (0.76-0.92) | 34        |
| Swelling†                                     | VC        | 186                            | 24             | 92             | 1.4 (1.2-1.7)    | 0.78 (0.67-0.91) | 34        |
| Urinary tract                                 |           |                                |                |                |                  |                  |           |
| Frequency                                     | VC        | 32*                            | 16 (NS)        |                |                  |                  | 8         |
| Dysuria                                       | VC        | 32*                            | 13 (NS)        |                |                  |                  | 8         |
|   | BV        | 27*                            | 11 (NS)        |                |                  |                  | 8         |
|   | BV        | 34                             | 32             |                |                  |                  | 40        |
| External dysuria                              | VC        | 186                            | 33             | 85             | 2.2 (1.6-2.9)    | 0.79 (0.71-0.88) | 34        |
| Other   |           |                                |                |                |                  |                  |           |
| "Another" yeast infection                     | VC        | 23                             | 35             | 90             | 3.3 (1.2-9.1)    | 0.72 (0.53-1.0)  | 12        |
| Abnormal bleeding                             | BV        | 67                             | 4              |                |                  |                  | 38        |

Abbreviations: BV, bacterial vaginosis; CI, confidence interval; LR, likelihood ratio; NS, reported by author to be not significantly associated with diagnosis; VC, vaginal candidiasis.

\*Patient may have had more than 1 diagnosis.

†Elicited by clinician.

**Table 3.** Accuracy of Symptoms for the Diagnosis of Vaginal Trichomoniasis

| Symptom                                | No. of Patients With Diagnosis | Sensitivity, % | Specificity, % | LR (95% CI)     |                 | Reference |
|--|--------------------------------|----------------|----------------|-----------------|-----------------|-----------|
|  |                                |                |                | Positive        | Negative        |           |
| Type of discharge described by patient |                                |                |                |                 |                 |           |
| Any                                    | 8*                             | 75 (NS)        |                |                 |                 | 8         |
|  | 17                             | 65             | 29             | 0.90 (0.63-1.3) | 1.2 (0.62-2.5)  | 39        |
| White                                  | 8*                             | 13 (NS)        |                |                 |                 | 8         |
| Yellow                                 | 8*                             | 50 (NS)        |                |                 |                 | 8         |
| Malodor or odor                        |                                |                |                |                 |                 |           |
| Any                                    | 8*                             | 50 (NS)        |                |                 |                 | 8         |
| "Fishy"                                | 13                             | 46             | 45             | 0.84 (0.45-1.6) | 1.2 (0.68-2.1)  | 32        |
| Itching                                | 17                             | 35             | 76             | 1.5 (0.74-3.0)  | 0.85 (0.59-1.2) | 39        |
|  | 8*                             | 75 (NS)        |                |                 |                 | 8         |
| Irritation                             | 8*                             | 63 (NS)        |                |                 |                 | 8         |
| Urinary tract                          |                                |                |                |                 |                 |           |
| Frequency                              | 8*                             | 38 (NS)        |                |                 |                 | 8         |
| Dysuria                                | 8*                             | 38 (NS)        |                |                 |                 | 8         |
|  | 17                             | 0              | 97             | 0.64 (0.04-10)  | 1.0 (0.85-1.3)  | 39        |
| Postcoital bleeding                    | 17                             | 0              | 97             | 0.9 (0.06-13)   | 1.0 (0.75-1.4)  | 39        |
| Dyspareunia                            | 17                             | 6              | 96             | 1.4 (0.18-11)   | 0.98 (0.87-1.1) | 39        |

Abbreviations: CI, confidence interval; LR, likelihood ratio; NS, reported by author to be not significantly associated with diagnosis.

\*Patient may have had more than 1 diagnosis.

**Table 4.** Accuracy of Signs for the Diagnosis of Vaginal Candidiasis

| Sign                                   | No. of Patients With Diagnosis | Sensitivity, % | Specificity, % | LR (95% CI)     |                  | Reference |
|--|--------------------------------|----------------|----------------|-----------------|------------------|-----------|
|  |                                |                |                | Positive        | Negative         |           |
| Type of discharge noted by clinician   |                                |                |                |                 |                  |           |
| Any                                    | 32*                            | 87 (NS)        |                |                 |                  | 8         |
| Yellow                                 | 32*                            | 16 (NS)        |                |                 |                  | 8         |
| White                                  | 32*                            | 63 (NS)        |                |                 |                  | 8         |
| Curdy                                  | 140                            | 16             | 97             | 6.1 (2.5-14)    | 0.86 (0.80-0.93) | 7         |
| Flocculent                             | 23                             | 43             | 84             | 2.7 (1.3-5.5)   | 0.67 (0.46-0.98) | 40        |
| Consistency of discharge               |                                |                |                |                 |                  |           |
| Thick                                  | 32*                            | 52             |                |                 |                  | 8         |
| Curdy                                  | 186                            | 18             | 99             | 15 (6.4-36)     | 0.83 (0.78-0.89) | 34        |
| Curdy                                  | 53                             | 72             | 100            | 130 (19-960)    | 0.28 (0.19-0.44) | 10        |
| Thin                                   | 32*                            | 48             |                |                 |                  | 8         |
| Inflammation                           |                                |                |                |                 |                  |           |
| Any                                    | 140                            | 46             | 78             | 2.1 (1.5-2.8)   | 0.69 (0.58-0.82) | 7         |
| Perineal edema or erythema             | 23                             | 57             | 77             | 2.5 (1.3-4.6)   | 0.56 (0.35-0.92) | 12        |
| Vulvar edema                           | 186                            | 17             | 98             | 7.8 (4.2-15)    | 0.85 (0.79-0.91) | 34        |
| Erythema or edema                      | 23                             | 91             |                |                 |                  | 40        |
| Vulvar erythema                        | 186                            | 54             | 79             | 2.5 (2.1-3.1)   | 0.58 (0.49-0.68) | 34        |
| Vaginal erythema                       | 186                            | 18             | 94             | 2.9 (1.9-4.5)   | 0.88 (0.82-0.94) | 34        |
| Vulvar excoriations                    | 186                            | 4              | 99             | 8.4 (2.3-31)    | 0.96 (0.93-0.99) | 34        |
| Vulvar fissures                        | 186                            | 17             | 96             | 4.6 (2.7-7.7)   | 0.86 (0.80-0.92) | 34        |
| Vaginal wall                           | 32*                            | 23             |                |                 |                  | 8         |
| Vulvar                                 | 53                             | 40             | 95             | 8.2 (4.0-16)    | 0.63 (0.51-0.79) | 10        |
| Cervical mucopus                       | 186                            | 21             | 72             | 0.75 (0.55-1.0) | 1.1 (1.0-1.2)    | 34        |
| Odor noted by clinician                |                                |                |                |                 |                  |           |
| Any                                    | 32*                            | 6              |                |                 |                  | 8         |
| "Fishy"                                | 24                             | 0              | 28             | 0.03 (0-0.47)   | 2.9 (2.4-5.0)    | 32        |
| Combined signs                         |                                |                |                |                 |                  |           |
| Curdy discharge or vulvar inflammation | 53                             | 81             | 95             | 17 (8.8-32)     | 0.20 (0.11-0.35) | 10        |
| Curdy discharge in presence of itching | 53                             | 77             | 100            | 150 (20-1000)   | 0.23 (0.14-0.37) | 10        |

Abbreviations: CI, confidence interval; LR, likelihood ratio; NS, reported by author to be not significantly associated with diagnosis.

\*Patient may have had more than 1 diagnosis.

than women with moderate (LR, 2.5; 95% CI, 1.7-3.8] to profuse (LR, 3.0; 95% CI, 0.32-28) discharge. A white discharge makes bacterial vaginosis less likely (range of LRs, 0.10 [95% CI, 0.01-0.74] to 0.55 [95% CI, 0.40-0.75]). One study reports that bloodstained, green,

clear, and purulent and frothy discharges are uncommon with bacterial vaginosis.<sup>35</sup> A yellow discharge increases the likelihood of both bacterial vaginosis (LR, 4.1; 95% CI, 2.4-7.1) and trichomoniasis (LR, 14; 95% CI, 6.1-31). All patients in one study

with trichomoniasis had a homogeneous discharge.<sup>10</sup>

**Inflammation.** Signs included a general impression of vulvar inflammation by the clinician and specific signs such as vulvar and/or vaginal edema, erythema, fissures, or excoriations. The

**Table 5.** Accuracy of Signs for the Diagnosis of Bacterial Vaginosis or Vaginal Trichomoniasis

| Sign                                 | Diagnosis | No. of Patients With Diagnosis | Sensitivity, % | Specificity, % | LR (95% CI)      |                  | Reference |
|--------------------------------------|-----------|--------------------------------|----------------|----------------|------------------|------------------|-----------|
|                                      |           |                                |                |                | Positive         | Negative         |           |
| Type of discharge noted by clinician |           |                                |                |                |                  |                  |           |
| Any                                  | BV        | 27*                            | 100 (NS)       |                |                  |                  | 8         |
| Vaginal discharge on vulvae          | BV        | 67                             | 64             |                |                  |                  | 38        |
| Normal                               | BV        | 81                             | 1              | 89             | 0.11 (0.01-0.86) | 1.1 (1.0-1.2)    | 9         |
| Mild                                 | BV        | 81                             | 33             | 37             | 0.53 (0.37-0.75) | 1.8 (1.3-2.5)    | 9         |
| Moderate                             | BV        | 81                             | 62             | 75             | 2.5 (1.7-3.8)    | 0.51 (0.38-0.69) | 9         |
| Profuse                              | BV        | 81                             | 4              | 99             | 3.0 (0.32-28)    | 0.98 (0.93-1.0)  | 9         |
| Color or appearance                  |           |                                |                |                |                  |                  |           |
| Bloodstained                         | BV        | 81                             | 1              | 99             | 1.0 (0.06-16)    | 1.0 (0.97-1.0)   | 9         |
| Clear                                | BV        | 81                             | 0              | 85             | 0.01 (0-0.16)    | 2.9 (1.6-5.4)    | 9         |
| Green                                | BV        | 81                             | 1              | 99             | 1.0 (0.06-16)    | 1.00 (0.97-1.0)  | 9         |
| Mucoid                               | BV        | 33                             | 3              | 100            | 1.6 (0.10-24)    | 0.99 (0.92-1.1)  | 35        |
| Purulent, frothy                     | BV        | 33                             | 30             | 51             | 0.62 (0.34-1.1)  | 1.4 (0.96-1.9)   | 35        |
| Yellow                               | BV        | 81                             | 60             | 85             | 4.1 (2.4-7.1)    | 0.46 (0.35-0.62) | 9         |
|                                      | BV        | 27*                            | 30 (NS)        |                |                  |                  | 8         |
|                                      | VT        | 8*                             | 50 (NS)        |                |                  |                  | 8         |
|                                      | VT        | 9                              | 89             | 93             | 14 (6.1-31)      | 0.12 (0.02-0.75) | 40        |
| White                                | BV        | 81                             | 37             | 32             | 0.55 (0.40-0.75) | 2.0 (1.4-2.8)    | 9         |
|                                      | BV        | 27*                            | 41 (NS)        |                |                  |                  | 8         |
|                                      | VT        | 8*                             | 13 (NS)        |                |                  |                  | 8         |
| Curdy                                | BV        | 33                             | 3              | 71             | 0.10 (0.01-0.74) | 1.4 (1.1-1.7)    | 35        |
| Consistency                          |           |                                |                |                |                  |                  |           |
| Homogeneous                          | VT        | 10                             | 100            | 60             | 2.2 (1.7-2.8)    | 0.15 (0.02-1.0)  | 10        |
| Thick                                | BV        | 27*                            | 12 (NS)        |                |                  |                  | 8         |
|                                      | VT        | 8*                             | 0 (NS)         |                |                  |                  | 8         |
| Thin                                 | BV        | 27*                            | 88 (NS)        |                |                  |                  | 8         |
|                                      | VT        | 8*                             | 100 (NS)       |                |                  |                  | 8         |
| Transparent                          | BV        | 33                             | 0              | 96             | 0.31 (0.02-6.3)  | 1.0 (0.97-1.1)   | 35        |
| Inflammation                         |           |                                |                |                |                  |                  |           |
| Erythema or edema                    | VT        | 17                             | 18             | 97             | 6.4 (1.6-26)     | 0.85 (0.68-1.1)  | 39        |
| Vulvar                               | BV        | 67                             | 1              |                |                  |                  | 38        |
|                                      | BV        | 67                             | 12             |                |                  |                  | 38        |
| Cervical                             | BV        | 67                             | 10             |                |                  |                  | 38        |
| Vaginal                              | BV        | 67                             | 15             |                |                  |                  | 38        |
| Vaginal wall                         | BV        | 27*                            | 33 (NS)        |                |                  |                  | 8         |
|                                      | VT        | 8*                             | 63 (NS)        |                |                  |                  | 8         |
| Uterine/adnexal tenderness           | BV        | 67                             | 12             |                |                  |                  | 38        |
| Odor noted by clinician              |           |                                |                |                |                  |                  |           |
| Any                                  | BV        | 27*                            | 78 (NS)        |                |                  |                  | 8         |
|                                      | VT        | 8*                             | 87 (NS)        |                |                  |                  | 8         |
|                                      | VT        | 8*                             | 50 (NS)        |                |                  |                  | 8         |
| High cheese                          | BV        | 81                             | 78             | 75             | 3.2 (2.1-4.7)    | 0.30 (0.19-0.45) | 9         |

Abbreviations: BV, bacterial vaginosis; CI, confidence interval; LR, likelihood ratio; NS, reported by author to be not significantly associated with diagnosis; VT, vaginal trichomoniasis.

\*Patient may have had more than 1 diagnosis.



presence of these signs is associated with candidiasis (range of LRs, 2.1 [95% CI, 1.5-2.8] to 8.4 [95% CI, 2.3-31]), although they can also occur in trichomoniasis (LR, 6.4; 95% CI, 1.6-26). The absence of these signs does not exclude the diagnosis of either candidiasis or trichomoniasis. No studies allow calculation of the LR of inflammation for bacterial vaginosis, but the prevalence of a variety of inflammatory signs was low.

**Odor.** The presence of a "fishy" odor perceived by the clinician makes candi-

diasis unlikely (LR, 0.03; 95% CI, 0-0.47), while the absence of an odor increases the likelihood (LR, 2.9; 95% CI, 2.4-5.0). In contrast, the presence of a "high cheese" odor makes bacterial vaginosis more likely (LR, 3.2; 95% CI, 2.1-4.7). Data on clinically perceived odors in trichomoniasis are limited.

#### Accuracy of Office Laboratory Tests

TABLE 6 and TABLE 7 present the sensitivity, specificity, and LRs for all office laboratory tests. We evaluated (1)

microscopy for clue cells and other findings associated with bacterial vaginosis, (2) microscopy for yeast (using saline or potassium hydroxide), (3) microscopy for trichomonads, (4) microscopic evidence of inflammation, (5) measurement of vaginal pH, and (6) the whiff test.

**Microscopy.** The sensitivity of microscopy for yeast varies from 38% to 83%. Consequently, the absence of yeast rules against candidiasis, but cannot exclude it (range of LRs, 0.46 [95% CI, 0.26-0.83] to 0.66 [95% CI, 0.47-0.92]).

**Table 6.** Accuracy of Office Laboratory Tests for the Diagnosis of Vaginal Candidiasis or Bacterial Vaginosis

| Laboratory Test                           | Diagnosis | No. of Patients<br>With Diagnosis | Sensitivity, % | Specificity, % | LR (95% CI)      |                  | Reference |
|---|-----------|-----------------------------------|----------------|----------------|------------------|------------------|-----------|
|   |           |                                   |                |                | Positive         | Negative         |           |
| Microscopy                                |           |                                   |                |                |                  |                  |           |
| Clue cells                                | VC        | 23*                               | 17             | 40             | 0.29 (0.12-0.73) | 2.0 (1.4-3.0)    | 12        |
|   | VC        | 24                                | 17             | 16             | 0.20 (0.08-0.49) | 5.4 (3.0-9.5)    | 32        |
|   | VC        | 32†                               | 19             |                |                  |                  | 8         |
| Curved rods                               | BV        | 34                                | 86             |                |                  |                  | 36        |
| Mobiluncus-type rods                      | BV        | 67                                | 53             |                |                  |                  | 38        |
| Bacilli with corkscrew motility           | BV        | 34                                | 65             | 100            | 44 (6.2-310)     | 0.36 (0.23-0.57) | 36        |
| Lactobacilli scant or absent              | BV        | 91                                | 90             | 68             | 3.1 (2.4-3.9)    | 0.02 (0-0.11)    | 10        |
| Yeast seen with potassium hydroxide       | VC        | 23*                               | 61             | 77             | 2.7 (1.4-4.9)    | 0.51 (0.30-0.86) | 12        |
|   | VC        | 186                               | 56             |                |                  |                  | 34        |
|   | VC        | 32†                               | 63             |                |                  |                  | 8         |
|   | VC        | 23                                | 83             |                |                  |                  | 40        |
|   | VC        | 21                                | 38             | 94             | 6.5 (2.5-17)     | 0.66 (0.47-0.92) | 6         |
|   | BV        | 27†                               | 19 (NS)        |                |                  |                  | 8         |
| Yeast seen with saline                    | VC        | 23*                               | 65             | 75             | 2.6 (1.5-4.6)    | 0.46 (0.26-0.83) | 12        |
| Yeast seen with saline and methylene blue | VC        | 23*                               | 64             | 83             | 3.7 (1.9-7.6)    | 0.44 (0.25-0.77) | 12        |
| Yeast seen with Gram stain                | VC        | 23*                               | 65             | 100            | 31 (4.4-220)     | 0.36 (0.20-0.62) | 12        |
| Trichomonads seen with saline             | VC        | 32†                               | 0 (NS)         |                |                  |                  | 8         |
|   | BV        | 27†                               | 11 (NS)        |                |                  |                  | 8         |
| Leukocytes more than epithelial cells     | VC        | 23*                               | 13             | 75             | 0.52 (0.16-1.7)  | 1.2 (0.92-1.5)   | 12        |
|   | BV        | 34                                | 36             |                |                  |                  | 36        |
| Leukocytes on slide                       | VC        | 32†                               | 25 (NS)        |                |                  |                  | 8         |
|   | BV        | 27†                               | 15 (NS)        |                |                  |                  | 8         |
| pH Level                                  |           |                                   |                |                |                  |                  |           |
| <4.5                                      | VC        | 140                               | 59             | 23             | 0.77 (0.66-0.90) | 1.8 (1.3-2.4)    | 7         |
|   | VC        | 32†                               | 67             |                |                  |                  | 8         |
|   | VC        | 23                                | 96             |                |                  |                  | 40        |
| <4.9                                      | VC        | 24                                | 71             | 90             | 7.2 (3.4-15)     | 0.32 (0.17-0.61) | 32        |
| >5.0                                      | VC        | 23*                               | 77             | 35             |                  |                  | 12        |
| Leukocyte count per high-power field      |           |                                   |                |                |                  |                  |           |
| <10                                       | BV        | 92                                | 77             |                |                  |                  | 31        |
| 10-50                                     | BV        | 92                                | 18             |                |                  |                  | 31        |
| >50                                       | BV        | 92                                | 4              |                |                  |                  | 31        |
| Whiff test positive                       | VC        | 23*                               | 17             | 45             | 0.31 (0.12-0.79) | 1.9 (1.3-2.7)    | 12        |
|   | VC        | 32†                               | 13 (NS)        |                |                  |                  | 8         |

Abbreviations: BV, bacterial vaginosis; CI, confidence interval; LR, likelihood ratio; NS, reported by author to be not significantly associated with diagnosis; VC, vaginal candidiasis.

\*For most tests, 1 to 2 patients had missing data for methylene blue, Gram stains, and whiff tests. For immunofluorescence tests, 16 patients had vaginal candidiasis.

†A patient may have had more than 1 diagnosis.

Because clue cells are part of the diagnostic criteria for bacterial vaginosis,<sup>41</sup> it is not possible to calculate LRs in this condition. Bacilli with corkscrew motility are highly associated with bacterial vaginosis (LR, 44; 95% CI, 6.2-310). The finding of scant or no lactobacilli is common in bacterial vaginosis (LR, 3.1; 95% CI, 2.4-3.9), whereas finding normal levels of lactobacilli makes bacterial vaginosis unlikely (LR, 0.02; 95% CI, 0-0.11). The presence of clue cells makes candidiasis unlikely (range of LRs, 0.20 [95% CI, 0.08-0.49] to 0.29 [95% CI, 0.12-0.73]), but has no impact on the diagnosis of trichomoniasis.

The identification of trichomonads in the wet mount diagnoses trichomoniasis, but their absence does not eliminate the diagnosis (range of LRs, 0.34 [95% CI, 0.17-0.64] to 0.96 [95% CI, 0.84-1.1]).

**Microscopic Evidence of Inflammation.** The presence of many leukocytes seems relatively uncommon in candidiasis and bacterial vaginosis. One study, however, found all 9 patients with trichomoniasis had more leukocytes than epithelial cells.<sup>40</sup>

**pH Level.** Four of 5 studies on pH in vaginal candidiasis reported that a majority of patients (59%-96%) had a normal pH (variably defined as  $\leq 4.5$  or  $\leq 4.9$ ). A fifth study found 77% of candidiasis patients had a pH of greater than 5.0.<sup>12</sup> Thus, a majority, but not all, of the studies report that candidiasis is associated with a normal pH. The pH in bacterial vaginosis should be high (pH $>4.5$ ) and is incorporated into the case definition. A majority of patients ( $>90\%$ ) with trichomoniasis will have an elevated pH, but the specificity (51%) has been evaluated in only 1 study. Unfortunately, given the overlap between the pH in various conditions, it is hard to draw firm conclusions from the existing literature.

**Whiff Test.** A positive whiff test makes candidiasis less likely (LR, 0.31; 95% CI, 0.12-0.79), but is positively associated with trichomoniasis (LR, 1.9; 95% CI, 1.3-2.7). A positive whiff test is one of the diagnostic criteria for bacterial vaginosis.

#### Are These Symptoms and Signs Ever Normal?

The distinction between normal and abnormal in terms of vaginal symptoms is

problematic. The primary literature on normal vaginal discharge is scant.<sup>42</sup> It appears that a normal vaginal discharge increases at mid-cycle (due to an increase in cervical mucus),<sup>43,44</sup> can be malodorous,<sup>45</sup> and may be accompanied by irritative symptoms (such as itch).<sup>46</sup> This problem is compounded by the fact that the vaginal pathogens identified by the current diagnostic approach can be found in asymptomatic women.<sup>47,48</sup> *Gardnerella* is part of the normal vaginal flora.<sup>49</sup> Thus, the identification of microbes in a vaginal discharge does not prove that they create symptoms.

## SCENARIO RESOLUTION

### Case 1

What is the appropriate diagnostic workup? No symptom has enough predictive power to allow the confident diagnosis of any of the 3 main causes of vaginitis. The wet mount examination remains the best way to make a diagnosis.

Symptoms and signs can suggest a particular diagnosis. Candidiasis is associated with itching, a cheesy discharge, redness, and self-diagnosis, while bacterial vaginosis is associated with increased discharge and a com-

**Table 7.** Accuracy of Office Laboratory Tests for the Diagnosis of Vaginal Trichomoniasis

| Laboratory Test                                | No. of Patients With Diagnosis | Sensitivity, % | Specificity, % | LR (95% CI)    |                  | Reference |
|--|--------------------------------|----------------|----------------|----------------|------------------|-----------|
|  |                                |                |                | Positive       | Negative         |           |
| Microscopy                                     |                                |                |                |                |                  |           |
| Clue cells                                     | 13                             | 69             | 33             | 1.0 (0.70-1.5) | 0.93 (0.39-2.2)  | 32        |
|  | 8*                             | 75 (NS)        |                |                |                  | 8         |
| Yeast seen with potassium hydroxide            | 8*                             | 13 (NS)        |                |                |                  | 8         |
| Trichomonads seen with saline                  | 8*                             | 75 (NS)        |                |                |                  | 8         |
|  | 9                              | 78             |                |                |                  | 40        |
|  | 18                             | 67             | 100            | 100 (14-740)   | 0.34 (0.17-0.64) | 23        |
|  | 10                             | 0              | 100            | 4.5 (0.1-217)  | 0.96 (0.84-1.1)  | 33        |
|  | 88                             | 60             | 100            | 310 (43-2200)  | 0.40 (0.31-0.52) | 37        |
|  | 55                             | 49             | 100            | 51 (7.1-360)   | 0.51 (0.40-0.67) | 11        |
| Leukocytes more numerous than epithelial cells | 9                              | 100            | 74             | 3.5 (2.3-5.2)  | 0.14 (0.02-0.87) | 40        |
| Leukocytes on slide                            | 8*                             | 25             |                |                |                  | 8         |
| pH Level                                       |                                |                |                |                |                  |           |
| <4.5   | 8*                             | 17             |                |                |                  | 8         |
| >4.9   | 9                              | 100            |                |                |                  | 40        |
| >5.4   | 13                             | 92             | 51             | 1.9 (1.4-2.5)  | 0.15 (0.02-1.0)  | 32        |
| Whiff test positive                            | 8*                             | 25 (NS)        |                |                |                  | 8         |
|  | 9                              | 67             | 65             | 1.9 (1.1-3.3)  | 0.51 (0.20-1.3)  | 40        |

Abbreviations: CI, confidence interval; LR, likelihood ratio; NS, reported by author to be not significantly associated with diagnosis.

\*A patient may have had more than 1 diagnosis.

plaint of odor. A watery discharge makes candidiasis unlikely.

Inflammatory signs are relatively specific for vaginal candidiasis but are not always present and do occur in trichomoniasis. An absent or mild discharge makes bacterial vaginosis unlikely. Odor noted on examination occurs in bacterial vaginosis but not in candidiasis.

Most diagnoses are made by microscopy and the whiff test. Most studies (but not all) would support that candidiasis is associated with a normal pH. While the microscopic identification of yeast or trichomonads is diagnostic, these causes cannot be ruled out by negative findings on microscopy. The presence of clue cells makes candidiasis less likely. A lack of lactobacilli and the presence of bacilli with corkscrew motility are 2 findings highly associated with bacterial vaginosis.

## Case 2

What do you do when the diagnostic workup fails? Despite a full history, physical examination, and microscopy, the workup in this case does not pinpoint a cause of the patient's symptoms. There are several possibilities to consider in patients for whom the diagnostic workup is inconclusive. It is quite possible that the algorithm has failed to diagnose vaginal candidiasis or trichomoniasis; clinicians should consider empirical therapy and/or further testing for trichomonads or *Candida*. Clinicians may want to consider less common causes of vaginal symptoms including gonorrhea, chlamydia, herpes, or genital warts. Finally, there may be no pathological condition causing the discharge and the clinician may elect, after discussion with the patient, an approach of watchful waiting.

## THE BOTTOM LINE

Our conclusions are subject to 2 important limitations. First, the LR<sub>s</sub> in these studies are not particularly robust. Second, despite dozens of articles devoted to the diagnosis of vaginal symptoms, we could locate only 18 that were useful in this review and none was of the highest methodological quality.

Current research on vaginitis has a number of weaknesses. Studies on vaginitis often mix together women with symptoms and those presenting for follow-up examinations or routine care. By analyzing data from these distinct patient groups as if they were one, the research fails to address either the question of how to diagnose patients with symptoms or how to screen for asymptomatic disease. The vocabulary of physical findings is not standardized (ie, what is a cheesy discharge?), case definitions for candidiasis and trichomoniasis are not clear, and multiple criterion standards are used. Scant attention has been paid to interobserver variability, which is a key issue in the clinical examination. Furthermore, most studies concentrate on diagnosing one particular etiology. However, the task facing the clinician is to choose among different etiologies. When 2 pathogens are identified in a study (mixed infections), it is conceptually difficult to clarify whether one, both, or neither is responsible for the symptoms. Finally, the studies on trichomonas, with only one exception, had fewer than 20 patients; this is not a good base on which to draw solid conclusions (a fact emphasized by the large 95% CIs of the LR<sub>s</sub>).

In addition to these limitations, the existing diagnostic approach fails to diagnose approximately 30% of women with vaginal symptoms. The time is ripe for new approaches to these complaints.

Despite these limitations, primary care clinicians need to be skilled in the diagnosis of vaginal candidiasis, bacterial vaginosis, and trichomoniasis. Patients may also have concerns regarding the meaning of these symptoms for their health and personal relationships<sup>50</sup> and these concerns need to be addressed sensitively. Recognizing that the clinical examination is a limited tool in this setting presents the challenge of finding ways to better diagnose and manage patients with vaginal symptoms. Vaginal symptoms may be the most common gynecological complaint in primary care, but much re-

mains to be learned about their clinical diagnosis.

**Author Contributions:** Dr Anderson had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

**Study concept and design:** Anderson, Klink, Cochrssen.

**Acquisition of data:** Anderson, Klink, Cochrssen.

**Analysis and interpretation of data:** Anderson, Klink, Cochrssen.

**Drafting of the manuscript:** Anderson, Klink, Cochrssen.

**Critical revision of the manuscript for important intellectual content:** Anderson, Klink, Cochrssen.

**Statistical expertise:** Anderson, Klink, Cochrssen.

**Administrative, technical, or material support:** Anderson, Klink, Cochrssen.

**Funding/Support:** This project received no external funding.

**Acknowledgment:** Dr Jean Abbott kindly provided additional data from her study, which we gratefully incorporated in this review. Dr Clyde Schechter provided invaluable assistance with the statistical analysis. Kathleen O'Toole assisted in reviewing data points from the included articles. Drs Lori Bastian, Joanne Piscitelli, and David Simel provided extensive and invaluable advice in the preparation of this article.

## REFERENCES

1. Kent HL. Epidemiology of vaginitis. *Am J Obstet Gynecol*. 1991;165(4 pt 2):1168-1176.
2. Mou S. Vulvovaginitis. In: Rakel RE, Bope ET, eds. *Conn's Current Therapy* 2003. Philadelphia, Pa: WB Saunders; 2003:1149-1152.
3. *Technical Bulletin No. 226: Vaginitis*. Washington, DC: American College of Obstetricians and Gynecologists; 1996.
4. Bickley LS. Acute vaginitis. In: Black ER, Bordley DR, Tape TG, Panzer RJ, eds. *Diagnostic Strategies for Common Medical Problems*. Philadelphia, Pa: American College of Physicians-American Society of Internal Medicine; 1999:255-268.
5. Mulley AG. Approach to the patient with a vaginal discharge. In: Goroll AH, Mulley AG, eds. *Primary Care Medicine: Office Evaluation and Management of the Adult Patient*. Philadelphia, Pa: Lippincott Williams & Wilkins; 2000:702-707.
6. Carlson P, Richardson M, Paavonen J. Evaluation of the Oricult-N dipstick for laboratory diagnosis of vaginal candidiasis. *J Clin Microbiol*. 2000;38:1063-1065.
7. Bro F. The diagnosis of *Candida* vaginitis in general practice. *Scand J Prim Health Care*. 1989;7:19-22.
8. Schaaf VM, Perez-Stable EJ, Borchardt K. The limited value of symptoms and signs in the diagnosis of vaginal infections. *Arch Intern Med*. 1990;150:1929-1933.
9. O'Dowd TC, West RR. Clinical prediction of *Gardnerella vaginalis* in general practice. *J R Coll Gen Pract*. 1987;37:59-61.
10. Chandeying V, Skov S, Kemapunmanus M, Law M, Geater A, Rowe P. Evaluation of two clinical protocols for the management of women with vaginal discharge in southern Thailand. *Sex Transm Infect*. 1998;74:194-201.
11. Bennett JR, Barnes WG, Coffman S. The emergency department diagnosis of *Trichomonas* vaginitis. *Ann Emerg Med*. 1989;18:564-566.
12. Abbott J. Clinical and microscopic diagnosis of vaginal yeast infection: a prospective analysis. *Ann Emerg Med*. 1995;25:587-591.
13. Burstein GR, Murray PJ. Diagnosis and management of sexually transmitted diseases among adolescents. *Pediatr Rev*. 2003;24:119-127.
14. Ryan CA, Courtois BN, Hawes SE, Stevens CE, Eschenbach DA, Holmes KK. Risk assessment, symptoms, and signs as predictors of vulvovaginal and cer-

- vical infections in an urban US STD clinic: implications for use of STD algorithms. *Sex Transm Infect.* 1998;74(suppl 1):S59-S76.
15. Stuart-Harris C. The epidemiology and clinical presentation of herpes virus infections. *J Antimicrob Chemother.* 1983;12(suppl B):1-8.
  16. Chiu A, Kelly K, Thomason J, Otte T, Mullins D, Fink J. Recurrent vaginitis as a manifestation of inhaled latex allergy. *Allergy.* 1999;54:184-186.
  17. Ludman B. Human seminal plasma protein allergy: a diagnosis rarely considered. *J Obstet Gynecol Neonatal Nurs.* 1999;28:359-363.
  18. Bachmann G, Nevadunsky N. Diagnosis and treatment of atrophic vaginitis. *Am Fam Physician.* 2000;61:3090-3096.
  19. Berg AO, Heidrich FE, Fihn SD, et al. Establishing the cause of genitourinary symptoms in women in a family practice: comparison of clinical examination and comprehensive microbiology. *JAMA.* 1984;251:620-625.
  20. Mayaud P, ka-Gina G, Cornelissen J, et al. Validation of a WHO algorithm with risk assessment for the clinical management of vaginal discharge in Mwanza, Tanzania. *Sex Transm Infect.* 1998;74(suppl 1):S77-S84.
  21. Wiesenfeld HC, Macio I. The infrequent use of office-based diagnostic tests for vaginitis. *Am J Obstet Gynecol.* 1999;181:39-41.
  22. Allen-Davis JT, Beck A, Parker R, Ellis JL, Polley D. Assessment of vulvovaginal complaints: accuracy of telephone triage and in-office diagnosis. *Obstet Gynecol.* 2002;99:18-22.
  23. Briselden AM, Hillier SL. Evaluation of affirm VP microbial identification test for *Gardnerella vaginalis* and *Trichomonas vaginalis*. *J Clin Microbiol.* 1994;32:148-152.
  24. Gwyther RE, Addison LA, Spottswood S, Bentz EJ, Evens S, Abrantes A. An innovative method for specimen autocollection in the diagnosis of vaginitis. *J Fam Pract.* 1986;23:487-488.
  25. Nugent RP, Krohn MA, Hillier SL. Reliability of diagnosing bacterial vaginosis is improved by a standardized method of Gram stain interpretation. *J Clin Microbiol.* 1991;29:297-301.
  26. Gardner HL, Dukes CD. *Haemophilus vaginalis* vaginitis: a newly defined specific infection previously classified "nonspecific" vaginitis. *Am J Obstet Gynecol.* 1955;69:962-976.
  27. Seattle STD/HIV Prevention Training Network. Examination of Vaginal Wet Preps. Available at: [http://depts.washington.edu/nnptc/online\\_training/wet\\_preps.html](http://depts.washington.edu/nnptc/online_training/wet_preps.html). Accessed June 2, 2003.
  28. *Diagnosis of Vaginitis.* Washington, DC: Association of Professors of Gynecology and Obstetrics; 1996.
  29. Association of Professors of Gynecology and Obstetrics. Available at: <http://www.apgo.org/bookstore/index.cfm?doc=Diagnosis%20of%20Vaginitis>. Accessed February 25, 2004.
  30. Centers for Medicare and Medicaid Services. Available at: <http://www.cms.gov/clia>. Accessed January 3, 2004.
  31. Abu Shaqra QM. Bacterial vaginosis among a group of married Jordanian women: occurrence and laboratory diagnosis. *Cytobios.* 2001;105:35-43.
  32. Bleker OP, Folkertsma K, Dirks-Go SI. Diagnostic procedures in vaginitis. *Eur J Obstet Gynecol Reprod Biol.* 1989;31:179-183.
  33. Borchardt KA, Hernandez V, Miller S, et al. A clinical evaluation of trichomoniasis in San Jose, Costa Rica using the InPouch TV test. *Genitourin Med.* 1992;68:328-330.
  34. Eckert LO, Hawes SE, Stevens CE, Koutsky LA, Eschenbach DA, Holmes KK. Vulvovaginal candidiasis: clinical manifestations, risk factors, management algorithm. *Obstet Gynecol.* 1998;92:757-765.
  35. Fule RP, Kulkarni K, Jahagirdar VL, Saoji AM. Incidence of *Gardnerella vaginalis* infection in pregnant and non-pregnant women with non-specific vaginitis. *Indian J Med Res.* 1990;91:360-363.
  36. Holst E, Wathne B, Hovelius B, Mardh PA. Bacterial vaginosis: microbiological and clinical findings. *Eur J Clin Microbiol.* 1987;6:536-541.
  37. Krieger JN, Tam MR, Stevens CE, et al. Diagnosis of trichomoniasis: comparison of conventional wet-mount examination with cytologic studies, cultures, and monoclonal antibody staining of direct specimens. *JAMA.* 1988;259:1223-1227.
  38. Livengood CH III, Thomason JL, Hill GB. Bacterial vaginosis: diagnostic and pathogenetic findings during topical clindamycin therapy. *Am J Obstet Gynecol.* 1990;163:515-520.
  39. Ryu JS, Chung HL, Min DY, Cho YH, Ro YS, Kim SR. Diagnosis of trichomoniasis by polymerase chain reaction. *Yonsei Med J.* 1999;40:56-60.
  40. Wathne B, Holst E, Hovelius B, Mardh PA. Vaginal discharge—comparison of clinical, laboratory and microbiological findings. *Acta Obstet Gynecol Scand.* 1994;73:802-808.
  41. Amsel R, Totten PA, Spiegel CA, Chen KC, Eschenbach D, Holmes KK. Nonspecific vaginitis: diagnostic criteria and microbial and epidemiologic associations. *Am J Med.* 1983;74:14-22.
  42. Anderson M, Karasz A, Friedland S. Can vaginal symptoms ever be normal? a review of the literature. Presented at: North American Primary Care Research Group Annual Meeting; November 3, 2002; New Orleans, La.
  43. Moghissi KS, Syner FN, Evans TN. A composite picture of the menstrual cycle. *Am J Obstet Gynecol.* 1972;114:405-418.
  44. Billings EL, Brown JB, Billings JJ, Burger HG. Symptoms and hormonal changes accompanying ovulation. *Lancet.* 1972;1:282-284.
  45. Doty RL, Ford M, Preti G, Huggins GR. Changes in the intensity and pleasantness of human vaginal odors during the menstrual cycle. *Science.* 1975;190:1316-1318.
  46. Priestley CJ, Jones BM, Dhar J, Goodwin L. What is normal vaginal flora? *Genitourin Med.* 1997;73:23-28.
  47. Bergman JJ, Berg AO. How useful are symptoms in the diagnosis of *Candida* vaginitis? *J Fam Pract.* 1983;16:509-511.
  48. Blake DR, Duggan A, Quinn T, Zenilman J, Joffe A. Evaluation of vaginal infections in adolescent women: can it be done without a speculum? *Pediatrics.* 1998;102(4 pt 1):939-944.
  49. Sobel JD. Vaginitis. *N Engl J Med.* 1997;337:1896-1903.
  50. Karasz A, Anderson M. The vaginitis monologues: women's experiences of vaginal complaints in a primary care setting. *Soc Sci Med.* 2003;56:1013-1021.
  51. Spiegel CA, Amsel R, Holmes KK. Diagnosis of bacterial vaginosis by direct Gram stain of vaginal fluid. *J Clin Microbiol.* 1983;18:170-177.